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MONTHLY WEIGHT AND BALANCE REPORT

FOR THE APOLLO SPACECRAFT

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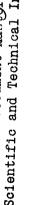
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1 OCTOBER 1963

Prepared by

Weight Control

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NORTH AMERICAN AVIATION, INC. SPACE and INFORMATION SYSTEMS DIVISION





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INTRODUCTION

The October report reflects a spacecraft weight increase of 175 pounds at injection and 75 pounds at the injected spacecraft condition less Service Module Propellant. The current injected weight of 84,540 pounds is based on the Service Module loaded with sufficient propellant at a specific impulse of 313.0 to provide 10 per cent \triangle V margin. This is based on a LEM weight, including crew, of 25,000 pounds.

As was indicated in the 1 September Report. SID 62-99-19, the Command Module weight has exceeded the proposed control weight of 9,500 pounds. The reported weight is based on the definitions and released drawings for AFRM-Oll. A weight reduction program is under way to reduce the Command Module weight for the LOR mission. Center of gravity improvement is being considered concurrently.

The major changes in the Command Module were due to the deletion of strakes, the addition of the second drogue chute system, and the redesign in forward heat shield thruster to solve the heat shield gap problem.

The major change in the Service Module was due to an increase in electrical power fuel intermodular plumbing.

The major changes in the Launch Escape System were due to the addition of the aerodynamic tower flap, the addition of tower to skirt separation capability, and the increase in ballast consistent with the combined Launch Escape System and Command Module balance requirements.

The earth orbital mission weight summary reflects a two stage booster-to-orbit injection without the use of Service Module propulsion and is based on a complete Service Module loaded with 2425 pounds of propellant. The earth orbit weight reported limits the orbital altitude capability with the Saturn I booster to 92 nautical miles. To obtain the 100 nautical mile orbital altitude with the Saturn I Booster will require off loading of the Command Module and Service Module.



APOLLO LOR MISSION

WEIGHT, CENTER OF GRAVITY AND INERTIA SUMMARY

Man I	WEIGHT	CENTE	CENTER OF GRAVITY*	VITY*	MOMENTS OF	F INERTIA (SLUG-FT.2)	UG-FT.2)
NOT T	POUNDS	×	→	2	ROLL (X)	PITCH (Y)	YAW (Z)
COMMAND MODULE	9700	1043.2	-0-1	8.1	6777	3895	3671
SERVICE MODULE - Less Propellant	9705	907.6	0.8	-0.7	96334	10358	10179
TOTAL - Less Propellant	19405	975.4	7.0	3.7	10765	33588	33104
PROPELLANT - S/M**	37275	905.7	5.7	-2.4	19350	20200	26200
TOTAL - With Propellant	56680	95676	3.9	-0.3	30297	67265	72758
LUNAR EXCURSION MODULE	577760	623.0	0.0	0.0	13616	12776	13247
ADAPTER - LEM - C-5	3700	642.7	0.0	0.0	8372	12273	12273
TOTAL - Injected	84540	829•3	2.6	-0.2	52346	062597	471554
LAUNCH ESCAPE SYSTEM	2070	1298.7	0.0	-0.2	267	10927	10929
TOTAL - SPACECRAFT LAUNCH	91580	7°598	2.4	-0.2	52622	785497	791532

*Centers of gravity are in the NASA reference system except that the longitudinal axis has an origin 1000 inches below the tangency point of the command module substructure mold line. NOTES:

**The propellant weight of 37275 pounds provides approximately 10% \triangle V margin, and is determined from an estimated time line analysis. The propellant weight is based on a specific impulse of 313.0.

-CONTIDENTIAL

APOILO EARTH ORBIT MISSION

WEIGHT, CENTER OF GRAVITY AND INERTIA SUMMARY

WELL 1	MEIGHT	CENT	CENTER OF GRAVITY*	AVITY*	O SINEMONIS O	MOMENTS OF INERTIA (SLUG-FT.2)	LUG-FT.2)
	POUNDS	×	Ħ	2	ROLL (X)	PITCH (Y)	(Z) MAY
COMMAND MODULE	9700	1043.2	-0.1	8.1	6777	3895	3671
SERVICE MODULE - Less Propellant	9705	907.6	8	-0.7	6234	10358	10179
TOTAL - Less Propellant	19405	975.4	7.0	3.7	10765	33588	33104
PROPELLANT - S/M**	2425	849.0	27.0	-11.7	830	097	2960
TOTAL - With Propellant	21830	961.3	3.3	2.0	12036	41590	47426
ADAPTER - C-1	830	7.677	0.0	0.0	1029	753	753
TOTAL - Injected	22660	954.7	3.2	1.9	13067	48038	92827
LAUNCH ESCAPE SYSTEM	27070	1298.7	0.0	-0.2	267	10927	10929
TOTAL - Spacecraft Launch	29700	1036.2	2.4	1.4	13351	196171	196017

*Centers of gravity are in the NASA reference system except that the longitudinal axis has an origin 1000 inches below the tangency point of the Command Module substructure mold line. NOTES:

**The earth orbital weights are based on a complete service module and includes 24.25 pounds of propellant for an orbital altitude of about 92 nautical miles with a payload launch azimuth of 72° .

APOLLO LAUNCH ABORT CONFIGURATION

WEIGHT, CENTER OF GRAVITY AND INERTIA SUMMARY

ITEM							
	WEIGHT	CENT	CENTER OF GRAVITY*	AVITY*	MOMENTS (MOMENTS OF INERTIA (SLUG-FT.2)	MUG-FT.2)
Pou	NUDS	×	H	2	ROLL (X)	PITCH (Y)	XAW (Z)
COMMAND MODULE	0026	1043.2	-0.1	8.1	67771	3895	3671
LAUNCH ESCAPE SYSTEM	20,40	1298.7	0.0	-0.2	267	10927	10929
TOTAL - Launch Abort 167	16740	7.0311	-0.1	4.6	4777	72362	72079
LESS - MAIN AND PITCH MOTOR -3210		1296.5	0.0	0.0	69-	-1330	-1330
TOTAL - LES Burnout 13530		0.9111	-0.1	5.7	6897	52778	52514

*Genters of gravity are in the NASA reference system except that the longitudinal axis has an origin 1000 inches below the tangency point of the command module substructure mold line. NOTE:

COMPLETA

COMMAND MODULE

WEIGHT, CENTER OF GRAVITY AND INERTIA SUMMARY

LUNAR ORBIT RENDEZVOUS MISSION

	WEIGHT	CENTER	R OF GRAVITY	/ITX	×	ASS INE	MASS INERTIA DATA (SLUG-FT.2)	A (SLUG	FT. ²)	
VEHICLE MODE	POUNDS	×	H	2	Į,	Iyy	Iss	Ixy	Ixe	Isy
EARTH LAUNCH	0026	1043.2	-0.1	8.1	6444	3895	3671	Ħ	-203	-37
ADJUSTMENTS (NET) Boost & Mission Coolants Food & Water Consumption Mission Waste Pickup Fuel Cell Water Pickup	494									
PRIOR TO ENTRY	294	1042.8	0.0	8.2	1644	3937	3706	77	-224	-31
Less: Propellant Ablator Burnoff Entry Coolant Forward Heat Shield Drogue Chute	-270 -223 -525 -50	1022.6 1019.7 1022.6 1098.3 1090.0	-5.1 0.0 -63.4 -0.1	56.6 11.2 -16.4 3.4						
PRIOR TO MAIN CHUTE DEPLOYMENT	8893	7.1401	0.2	7.1	090†	3329	3195	17	-133	-32
Less: Main Chutes (3)	-461	1089.9	0.3	6.7						
LANDING	8432	1039.1	0.2	7.1	4013	3066	2912	16	-131	-32

NOTE: Mass inertia data is shown for accumulative totals only.

COMMAND MODULE

WEIGHT, CENTER OF GRAVITY AND INERTIA SUMMARY

HIGH ALTITUDE ABORT CONDITION

	UPTCH	CENT	GENTER OF GRAVITY	AVITY		MASS IN	MASS INERTIA DATA (SLUG-FT.2)	TA (SLU	G-FT.2)	
VEHICLE MODE	POUNDS	H	Ā	2	ğ	Lyy	Isz	Ixy	Ixa	Izy
EARTH LAUNCH	002.6	1043.2	-0.1	8.1	6444	3895	1296	11	-203	-37
Less: Boost Coolants	7-	7.6101	-51.0	-21.0						
PRIOR TO ENTRY	9896	1043.2	0.0	8.1	14,38	3891	3661	7	-205	-41
Less: Propellant Ablator Burnoff	-270	1022.6	-5.1	56.6 11.2						
Entry Coolant Forward Heat Shield	-325	1022.6	-63.4	3.4						
Drogue Chute	-20	0.0601	0,0	-220		The sector's agency will see				
PRIOR TO MAIN CHUTE DEPLOYMENT	8979	1041.8	0.2	7.0	9117	3393	3256	ı	-116	-42
Less: Main Chutes (3)	-461	1089.9	0•3	6.7	-					
Lending	8518	1039.2	0.2	7.0	8907	3130	2974	ı	-115	-42

NOTE: Mass inertia data is shown for accumulative totals only.

COMMAND MODULE

WEIGHT, CENTER OF CRAVITY AND INERTIA SUMMARY

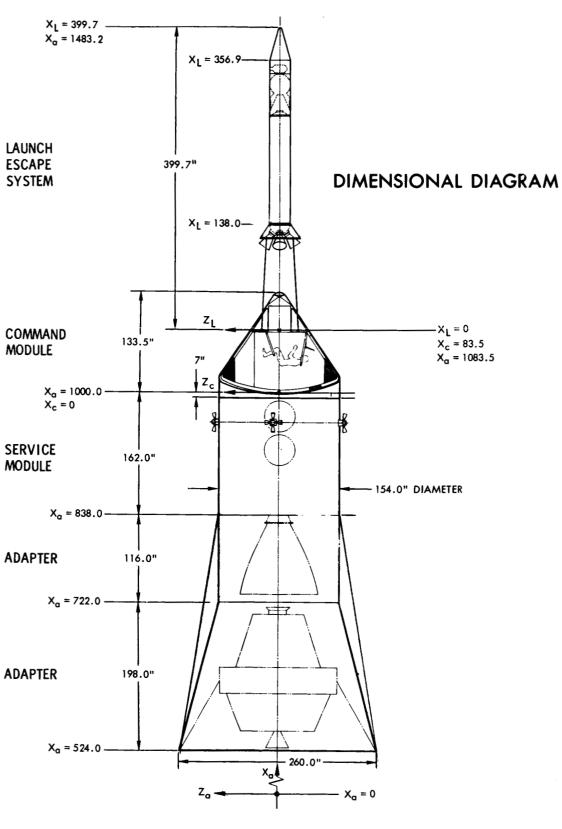
LOW ALTITUDE ABORT CONDITION

BOOM STOTUM	WEIGHT	CENT	CENTER OF GRAVITY	VITY		MASS IN	mass inertia data (slug-ft.²)	ATA (SL	UG-FT. ²)	
	POUNDS	×	H	2	ğ	Iyy	122	Į,	Lxx	Isy
EARTH LAUNCH	9700	1043.2	-0.1	۲ . 8	6777	3895	3671	11	-203	-37
Less: Propellant Forward Heat Shield Drogue Chute	-270 -336 -50	1022.6 1098.3 1090.0	4.00 0.0	56.6 314 -22.0	er d nja tik, trost n j. nojkoj koj kojim kojim					
PRIOR TO MAIN CHUTE DEPLOYMENT	7706	1041.5	0.0	7.0	8917	3425	3297	70	-115	-36
Less: Main Chutes (3)	-461	1089.9	0.3	6.7						
LANDING	8583	1038.9	0.0	7.0	1217	3160	3012	7	-113	-36

NOTE: Mass inertia data is shown for accumulative totals only.









COMPIDENTIAL

SPACECRAFT

WEIGHT STATUS SUMMARY

ITEM	PREVIOUS STATUS	CHANGE TO	CURRENT WEIGHT	BASIS	FOR CUI	RRENT
	9-1-63	CURRENT	10-1-63	%EST	%CAL	%act
COMMAND MODULE	9650	+50	9700	52	46	2
SERVICE MODULE	46855	+125	46980	5	95	
LES	6650	+390	7040	38	53	9
ADAPTER	3400		3400	100		
TOTAL	66555	+565	67120	20	79	1

			minadio	2 4 4	mwadamo doa	m vaco
	PREVIOUS	CHANGE	WETCH!	DASTS	FOR OF	LUCIU I
MOLI	9-1-63	CURRENT	10-1-63	KEST.	%CAL	%ACT
Structure Structure - Less Ablator Ablation Material	(4567) 3290 1277	(-22) -59 +37	(4545) 3231 1314	18	89	
Crew Systems	331		331	95	٠	
Communications	368		368	100		
Instrumentation	193		193	100		
Controls and Displays	286	1 5	281	100		
Guidance and Navigation	425		425	100		
Stabilization and Control	237	+ 5	242	100		
Reaction Control	328		328	78	16	
Electrical Power	431	+	757	36	80	
Environmental Control	292	6 -	283	75	97	
Earth Landing	598	+75	673	ង	63	25
WEIGHT EMPTY	8056	L77+	8103	54	1	~
Crew (3), (50, 70, 90 percentile)	528		528		100	
Crew System Equipment	293	+ 3	296	93	8	77
Food and Containers	8		06	100		
Reaction Control Propellant	270		270		100	
Environmental Control Chemicals	163		163		100	
Scientific Payload	250		250	100		
GROSS WEIGHT	9650	+50	9700	33	94	~

COMMAND MODULE WEIGHT STATUS



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COMMAND MODULE

STRUCTURE	(-22.0)
Basic Body Structure	
Increase forward heat shield ejection fittings due to redesign caused by ejector change to solve gap problem.	+4.0
Heat Shield Substructure	
Delete side mounted aerodynamic strakes and mount the scimitar antennas on the heat shield.	-63,0
Ablation Material	
Increase ablation material in the center section due to the perturbation effect around the protruding scimitar antennas.	+37.0
CONTROLS AND DISPLAYS	(-5.0)
Decrease CMT readout due to changing from a GMT digital readout to a hand wound clock.	-4.2
Decrease flight director attitude indicator due to a change in internal structure material from steel to aluminum.	-0.4
Decrease Rotational Manual Controls due to changing frame chassis material from aluminum to magnesium.	-0.2
Decrease SCS control panel due to miscellaneous actual weights by Minneapolis Honeywell.	-0.2
STABILIZATION AND CONTROL	(+5.0)
Increase electronic control packages based on the current Minneapolis Honeywell report reflecting some miscellaneous actual weights.	+5.0
, 5	





COMMAND MODULE

ELECTRICAL POWER		(+3.0)
Increase battery circuit breaker due to the addition of pyrotechnic battery circuit breaker requirements.		+2.4
Increase electrical common utility installation provisions based on revised calculations of released drawings.		+0.6
ENVIRONMENTAL CONTROL		(-9.0)
Decrease pressure suit circuit based on current AiResearch status reflecting following changes:		-3.7
Deletion of regenerative heat exchanger not required now since one crew man is to be in a pressure suit at all times.	-6.9	
Increase in detail parts based on calculations of detail drawings.	+3.2	
Increase water-glycol circuit based on current AiResearch status reflecting the addition of glycol pump diverter valve.		+0.2
Decrease pressure and temperature control circuit based on current AiResearch status.		-0.6
Decrease oxygen supply system based on current AiResearch status reflecting a decrease in the demand pressure regula and relief valve based on current detail calculations.	tor	-0.2
Decrease water supply system based on current AiResearch state reflecting current detail calculations.	us	-0.4
Decrease Subcontractor Common Items based on the following:		-6.4
Reduction in miscellaneous brackets and supports based on partial calculated and actual weights.	-0.8	
Deletion of transducer for pressure re-entry oxygen bottle from AiResearch components as AiResearch is no longer responsible for the re-entry oxygen system.	-1.5	
Deletion of allowance for radio noise filter due to incorporation into component weights.	-4.1	



COMMENTAL

COMMAND MODULE

ENVIRONMENTAL	CONTROL (Continued)
TWA A TICOMMETIM TWT	COMITION (Compania

Decrease supports due to partial calculations of released drawings.	-0. 7
Addition of nitrogen purge system due to requirement that the vehicle is considered a hydrogen-hazardous area and must be	
purged prior to loading propellant.	+2.8
EARTH LANDING SYSTEM	(+75.0)
Increase drogue chute system due to addition of a second drogue for added reliability.	+34.5
Increase main cluster based on Northrop Ventura status reflecting the following:	+2.7
Change in main chute pack due to material specification change for the suspension lines5.8	
Redesign of retention assembly due to requirement for additional straps. +3.4	
Addition of protectors and pads for the links and clevis. +5.1	
Decrease sequence control assembly due to deletion of requirements for two time delay switches and two relays per Northrop status.	-0.6
Increase attach provisions due to a requirement for a dual drogue system.	+8.8
Decrease location aids due to revised dye marker specfication weights and deletion of dye marker ejector requirement per Northrop Ventura.	-3.7
Increase forward heat shield release system due to redesigning the jettison thrusters to incorporate a spring loaded forward heat shield passive retention system to solve the heat shield	
gap problem.	+28.3
Increase drogue disconnect installation due to a requirement for a dual drogue system.	+4.0
Increase pyrotechnic provision due to added requirement for the dual drogue system.	+1.0
TOTAL COMMAND MODILE WEIGHT EMPTY CHANGES	+47.0



COMMAND MODULE

CURRENT USEFUL LOAD CHANGES

Increase Crew Systems due to the additional requirement for three	
suit electrical umbilicals.	+3.0

TOTAL COMMAND MODULE CURRENT USEFUL LOAD CHANGES

+3.0





N.H.J. I	PREVIOUS	CHANGE	CURRENT	BASIS	FOR CURRENT	RENT
1.17.7.7	9-1-63	CURRENT	10-1-63	%EST	%CAL	%ACT
Structure	2265		2265	17	73	10
Electronics	177		177	100		
Reaction Control	580		280	19	39	
Electrical Power	1319	+20	1339	15	83	N
Environmental Control	87	+	92	16	27	77
Propulsion System Engine Installation Propulsion System	(3022) 715 2307		(3022) 715 2307	82 15	18	
WEIGHT EMPTY	7450	+25	7475	28	69	m
RCS Propellant	838		838		100	
Electrical Power Supercritical Fluids	503		503		100	
Environmental Control Supercritical Fluids	208		208		100	
Main Propulsion Helium	66		66		100	
Main Propellant Residuals Trapped - System Trapped - Engine Mixture Ration Tolerance Loading Tolerance	(582) 225 67 100 190		(582) 225 67 100 190		100	
BURNOUT WEIGHT	0896	+25	9705	22	92	2
Main Propellant	37175	+100	37275		100	
GROSS WEIGHT	46855	+125	08697	5	95	

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TEMPONTIAL

SERVICE MODULE

ELECTRICAL POWER SYSTEM	(+20.0)
Increase intermodular radiator plumbing and supports due to calculated versus estimated weights based on released drawings. The estimates were based on aluminum tubing and the current drawings released as steel.	+18.7
Decrease supercritical gas storage system subcontractor components based on Beech's status report reflecting a redesign of supports.	-0.7
Increase fuel cell hydrogen system plumbing and supports due to calculated versus estimated weights based on released drawings.	+2.5
Increase fuel cell oxygen system plumbing and supports due to calculated versus estimated weights based on released drawings.	+4.1
Decrease power distribution box due to elimination of mounting shelves and miscellaneous detail changes.	-7.9
Increase separation provision due to calculations of shaped charge assembly based on prereleased drawings.	+3.3
ENVIRONMENTAL CONTROL	(+5.0)
Increase common items supports and hardware due to additional calculated hardware.	+5.0
TOTAL SERVICE MODULE CURRENT WEIGHT EMPTY CHANGES	+25.0







LAUNCH ESCAPE SYSTEM

WEIGHT STATUS

	PREVIOUS STATUS 9-1-63	CHANGE TO CURRENT	CURRENT WEIGHT 10-1-63	BASI	S FOR C	URRENT
	7-1-07	COMMI	10-1-07	%EST	%CAL	%ACT
Structure	998	+64	1062	9	75	16
Electrical System	41	+17	58	100		
Propulsion System Main Thrust Jettison Jettison Motor Skirt Pitch Control	4764 434 92 55		4764 434 92 55	40	60 40	100
Separation Provisions	13	+54	67	61	39	
LES - NO BALLAST	6397	+135	6532	33	57	10
BALLAST	253	+255	508	100		
TOTAL L.E.S.	6650	+390	7040	38	53	9





LAUNCH ESCAPE SYSTEM

CURRENT WEIGHT CHANGES

STRUCTURE	(+64)
Increase tower assembly due to the following:	+59
Addition of aerodynamic tower flap which will be used in conjunction with the tower to stabilize the Command Module during aborts between the altitudes	
of approximately 30,000 feet and 220,000 feet. +49 Addition of truss for Command Module forward heat shield pull off during low level aborts for	
altitudes lower than 30,000 feet. +10	
Decrease escape motor skirt assembly due to calculations of release drawings reflecting additional machining of fittings and frames.	
Decrease nose cone and ballast supports due to partial actual weights of frames.	-4
Decrease attaching parts due to changing the tower skirt attaching bolts to explosive bolts. These bolts are now reported in the Separation System.	- 5
Increase tower insulation due to the following:	+34
Addition of insulation to the aerodynamic flap. +31 Addition of insulation to the truss for the Command Module heat shield pull off. +3	
SEPARATION PROVISIONS	(+54)
Increase separation provisions due to adding tower to skirt dual separation capability.	+54
ELECTRICAL POWER	(+17)
Increase electrical power due to additional sequences and wiring required for tower to skirt separation.	+17
BALLAST	(+255)
Increase ballast consistent with new combined Launch Escape System and Command Module Balance requirements about Station 1116 in lieu of Station 1109.	+255
TOTAL LAUNCH ESCAPE SYSTEM CURRENT WEIGHT CHANGES	+390





ADAPTER

WEIGHT STATUS

ITEM	PREVIOUS STATUS	TO N	CURRENT WEIGHT	BASIS	FOR CUI	RRENT
	9-1-63	CURRENT	10-1-63	%FST	%CAL	%ACT
Structure	3070		3070			
Electrical	80		80			
Separation System	250		250			
TOTAL ADAPTER	3400		3400	100		







WEIGHT HISTORY COMMENTS

LAUNCH ESCAPE SYSTEM

The design goal established for the LES is 6,300 pounds, excluding ballast. This weight was based on the September 1962 status weight of 6,600 pounds, including the necessary ballast to provide currently determined aerodynamic stability to prevent tumbling.

The original design goal of 5,900 pounds, as reported in the June status, SID 62-99-5, was based on an attitude controlled configuration. The current configuration weight includes a pitch motor and ballast not included in the original target weight.

COMMAND MODULE

The design goal established for the Command Module is 8,500 pounds. An estimated weight breakdown for the design goal is provided for comparative purposes.

The original design goal weight of 8,340 pounds, as reported in the June status, SID 62-99-5, did not include the proposed increases nor the Category I reductions presented in the July briefing and incorporated in the July Status Report.

SERVICE MODULE

The design goal established for the Service Module less usable propellant is 11,000 pounds. An estimated weight breakdown for the design goal is provided for comparative purposes. This configuration is sized for 45,000 pounds usable propellant for the 25,000 pound LEM.

The original design goal weight of 8,595 for the burnout condition was based on a lunar configuration sized for 31,000 pounds usable propellant.





CONCLDENTIAL

WEIGHT HISTORY

COMMAND MODULE

	DESIGN GOAL	AUTHORIZED CHANGES	DESIGN GOAL ADJUSTED 10-1-63
Structure	3824	+125	3949
Crew Systems	530		530
Communication	330	+33	363
Instrumentation	173	+7	180
Controls & Displays	261	+2	263
Guidance & Navigation	261	+164	425
Stabilization & Control	181		181
Reaction Control	195		195
Electrical Power	390	+11	401
Environmental Control	235	-12	223
Earth Landing	610		610
WEIGHT EMPTY	6990	+330	7320
Crew	528		528
Suits & Personal Equipment	304	-7	297
Food & Containers	90		90
Reaction Control Propellant	210		210
Environmental Control Fluids	128		128
Scientific Payload	250		250
GROSS WEIGHT	8500	+323	8823







COMMAND MODULE WEIGHT HISTORY

WEIGHT EMPTY AUTHORIZED CHANGES

STRUCTURE	(+125)
Change parachute attach to a two leg configuration for incorporation of the "Tumbling Concept" at earth impact attenuation. (CCA No. 93)	+125
COMMUNICATIONS	(+33)
Add a spacecraft up-data link for the purpose of providing current GOSS data within the spacecraft for display and comparison with the on-board computed data. (CCA No. 54).	+35
Change the present two speed data storage to a three speed machine to provide fast dump of data. (CCA No. 59)	-2
INSTRUMENTATION	(+7)
Increase the PCM output bit rate from 31,000 to 51,200 bit/sec. This change was originally considered to have negligible weight affect but has henceforth been reported by Collins to cause a seven pound increase. (CCA No. 44)	+7
CONTROLS & DISPLAYS	(+2)
Furnish and install a clock timer panel at the navigation station lower equipment bay.	+2
GUIDANCE & NAVIGATION	(+164)
Increase the Guidance and Navigation per recent weight report from M.I.T. Since NAA does not have weight control responsibility for the M.I.T. design, the weight changes in their Weight and Balance Report will be considered as authorized changes.	+164
ELECTRICAL POWER	(+11
Add two batteries to provide a source of power, separate from the primary D.C. power, to initiate pyrotechnic devices. (CCA No. 28).	+10
Add PLSS battery charging control to prevent overcharging battery. (CCA No. 82)	+1





CONTRACTAL

COMMAND MODULE WEIGHT HISTORY

WEIGHT EMPTY AUTHORIZED CHANGES

ENVIRONMENTAL CONTROL	(-12)
Add a CO ₂ sensor to the ECS as a part of the ECS operational instrumentation. (CCA No. 43)	+2
Add a surge tank to ECS and delete entry oxygen supply to provide early mission emergency gas flows. (CCA No. 52)	-7
Deletion of regenerative heat exchanger from the ECS heat exchanger package. (CCA No. 63)	- 7
TOTAL COMMAND MODULE WEIGHT EMPTY CHANGES	+330





TOTAL BOOKS LAL

COMMAND MODULE WEIGHT HISTORY

USEFUL LOAD AUTHORIZED CHANGES

SUITS & PERSONAL EQUIPMENT		(-7)
Change the following GFE (NASA) responsibility items:		·
Increase personal radiation dosimeters per		
NASA Crew Systems Meeting Number 19, Action Item Number 6.	+10	
Increase PLSS per Hamilton Standard status.	+36	
Delete initial charge water for coolant, from		
PLSS, as this item is now carried in the potable water tank.	- 5	
Delete one PLSS consistent with requirements for LOR mission.	-48	
	.,.	-
TOTAL COMMAND MODILE USEFUL LOAD CHANGES		-7







WEIGHT HISTORY

SERVICE MODULE

	DESIGN GOAL	AUTHORIZED CHANGES	DESIGN GOAL ADJUSTED 10-1-63
Structure	3203		3203
Electronics	145		145
Reaction Control	737		737
Electrical Power	1203		1203
Environmental Control	250		250
Propulsion System Engine Installation Propellant System	606 2456		606 2456
WEIGHT EMPTY	8600		8600
Usable RCS Propellant Usable Fuel Cell Reactants Environmental Control Fluids Main Propulsion Helium Main Prop. Residuals Unusable RCS Propellant Unusable Fuel Cell Reactants	611 479 193 139 900 61		611 479 193 139 900 61
BURNOUT WEIGHT	11000		11000
Main Propellant	45000		45000
GROSS WEIGHT	56000		56000





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POTENTIAL WEIGHT AND CENTER OF GRAVITY CHANGES

COMMAND MODULE

STRUCTURE	(-57)
Addition of crushable HCB core installation in aft compartment.	+25
Incorporation of oxidizer dump in aft heat shield.	+ 3
Reduction of heat shield window glass thickness from 0.70 to 0.55 inches.	-10
Incorporation of pressure vent in aft compartment.	+25
Main parachute yoke installation study.	- 20
Refinement of structure beyond AFRM Oll.	-100
Increase in aft equipment bay due to electronic component storage compartments.	+20
CREW SYSTEMS	(-183
Remove primary 02 from remaining PLSS back packs.	-1
Remove food from survival kits.	- 3
Change in crew and metabolic criteria based on astronaut data and new NASA metabolic rates.	
Crew Food and Containers	-49 -12
Change crew couch pads from insolite to trilok.	-5
Reduce life rafts.	-9
Reduce or eliminate portable light.	-3
Increase crew couch attenuation.	+21
Refinement of waste management and deletion of urine disposal system or the chemical disinfectant.	-10
Delete requirement for the PLSS as there is no extra vehicular missions planned from the Command Module.	-45



COMPLETE

POTENTIAL WEIGHT AND CENTER OF GRAVITY CHANGES

COMMAND MODULE

CREW_SYSTEMS (CONTINUED)

Decrease mission duration from 14 days to 8 days:

Food and Containers Chemical Disinfectant Personal Hygiene Equipment	-38 -2 -4
Remove thermal coveralls	- 13
COMMUNICATION & INSTRUMENTATION	(-7)
Repackage PCM components.	-18
Add electrical provisions for test instrumentation to monitor C-1 and C-5 booster per NASA.	+16
Utilize Conic Corporation VHF/FM and unmodular HF.	- 8
Add provisions for flight qualification PCM.	+10
Utilize Rantec multiplexer.	- 7
STABILIZATION & CONTROL	(-40)
Decrease SCS packages per M-H weight reduction study including design refinements such as machining base plates, reducing potting and optimizing side panels.	-40
REACTION CONTROL SYSTEM	(+2)
Propellant tank increase.	+2
ELECTRICAL POWER SYSTEM	(+112)
Delete battery charger for PISS.	-1
Decrease battery charger.	-1
Increase battery weight per Eagle-Picher 5 August 1963 status.	+14
Increase electrical wiring.	+100





COMPLETE

POTENTIAL WEIGHT AND CENTER OF GRAVITY CHANGES

COMMAND MODULE

ENVIRONMENTAL CONTROL SYSTEM	(-111)
Relocate suit umbilical control connections.	-8
Reduce lithium hydroxide and containers per change in Crew and Metabolic criteria based on astronaut data and new NASA metabolic rates.	-18
Reduce quantity requirements of lithium hydroxide due to mission duration decrease from 14 days to 8 days.	- 55
Change in 78g requirements to comply with structure criteria (AiResearch items).	-8
Addition of third glycol pump and cold plate redundancy.	+10
Addition of pressure transducer, two check valves and two shut-off valves to 0_2 surge tank.	+2
Investment castings in lieu of precision sand castings on suit compressor and glycol pump.	- 5
Delete two lithium hydroxide charges by raising the maximum allowable CO ₂ content.	- 9
Combining AiResearch components.	- 7
Addition of radiator controller.	+6
Simplified ECS water management, cooling system, and deletion of freon system.	-11
Delete recharging provisions for PISS.	-9
Addition of 02 surge tank instrumentation (NASA requirement per letter 9569 MA, dated July 23, 1963).	+2
EARTH LANDING SYSTEM	(-25)
Main parachute yoke installation.	-25
LEM INTEGRATION	(+166)
Modify structure to incorporate mating and locking capabilities and to strengthen hatch for impact loads.	+150
Add rendezvous beacon radar installation as an aid during the rendezvous phase.	+16



ACCURATION OF

POTENTIAL WEIGHT AND CENTER OF GRAVITY CHANGES

COMMAND MODULE

SCIENTIFIC EQUIPMENT	(-170)
Remove from Lower Equipment Bay.	- 35
Remove from Right Hand Equipment Bay.	-135
TOTAL POTENTIAL CHANGES, COMMAND MODULE	-313





POTENTIAL WEIGHT AND CENTER OF GRAVITY CHANGES

SERVICE MODULE

STRUCTURE	(-55)
Replace aluminum honeycomb sandwich in aft heat shield with stiffened fiberglas sheet.	- 55
ELECTRICAL POWER	(-355)
Revise the Supercritical Gas Storage System, based on co-ordination with the subcontractor (Beech Aircraft), to include the following changes:	- 25
Reduction of insulation preloading from 2 to $\frac{1}{2}$ psi, H ₂ tank7	
Fan heaters in lieu of electrofilm heaters cryrogenic system20	
Sculpturing material on complete system13	
Reduction in titanium stress allowable. +15	
Reduce H ₂ for 8 day mission in lieu of 14 day.	-12
Reduce 02 for 8 day mission in lieu of 14 day.	-280
Decrease in Fuel Cell Power System, based on Pratt & Whitney's weight report reflecting the following:	- 38
Compact Secondary Regenerator -7 Unitized Gas Manifolds -6 Close control of electrode filling techniques -10 Thinner electrode spacing -15	





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POTENTIAL WEIGHT AND CENTER OF GRAVITY CHANGES

SERVICE MODULE

ENVIRONMENTAL CONTROL	(+87)
Add provisions for nitrogen purging of the service module to prevent accidental explosion on the pad.	+15
Addition of radiator controller.	+2
Addition of propellant heating system to maintain fuel at temperatures above freezing point.	+70
TOTAL POTENTIAL WEIGHT CHANGES - SERVICE MODULE	- 323





CONTRACTOR

DETAIL WEIGHT STATEMENT

COMMAND MODULE

SUMMARY

ITEM		CURRENT WEIGHT 10-1-63
WEIGHT EMPTY		8103
Structure	4545	
Crew Systems	331	
Communications	368	
Instrumentation	193	
Controls & Displays	281	
Guidance & Navigation	425	
Stabilization & Control	242	
Reaction Control	328	
Electrical Power	434	
Environmental Control	283	
Earth Landing	673	
USEFUL LOAD		1597
Crew Systems	914	
Reaction Control	270	
Environmental Control	163	
Scientific Payload	250	
GROSS WEIGHT		9700





NORTH AMERICAN AVIATION, INC.

SPACE and INFORMATION SYSTEMS DIVISION

DETAIL	WEIGHT	STATEMENT
CC	DMMAND I	MODULE
STRUCTURE		

CURRENT WEIGHT

ITEM			10-1-63
STRUCTURE			
Basic Body Structur	e		(1044)
Forward Section			181
H oneyco mb		56	
Frames, Rings	and Hatches	57	
Fittings and	Attachments	68	
Center Section			670
Honeycomb Pan	els	210	
Longerons, Fr	ames and Rings	263	
Window and Ha	tches	105	
Fittings and	Attachments	92	
Aft Section			193
Honeycomb Pan	el	116	
R ing		77	
Secondary Structure			(566)
RH Equipment Bay	and Coldplates		74
LH Equipment Bay			86
Fwd. LH Equipmen	t Bay		20
Fwd. RH Equipmen	t Bay and Coldplates		20
Main Display Pan	el and Coldplates		65
	Bay and Coldplates		198
Aft Equipment Ba	y		44
Crew Area			20
Heat Shield Equi			39
Heat Shield Substru	cture		(1404)
Forward Section			189
Honeycomb Pan	els	108	
Frames and Ri	ngs	31	
Fittings and	Mechanism	50	
Center Section			689
Honeycomb Pan	els	244	
Frames and Ri		109	
Doors and Cov		190	
	hanism and Attachments		
Antenna Insta	.llation	16	
Aft Section	_		526
Honeycomb Pan		358	
Frames and Ri		47	
Fittings and		81	
Toroidal Asse	mbly	40	4
Ablation Material			(1314)
Forward Section			139
Center Section			577
Aft Section			598
Insulation			(195)
			.
Separation Provision	ons and Attachments		(22)

TOTAL STRUCTURE

4**545**



COMMISSION

DETAIL WEIGHT STATEMENT

COMMAND MODULE

CREW SYSTEMS

ITEM	CURRENT WEIGHT 10-1-63
CREW SYSTEMS	
Crew Couch Support and Restraint System	30.0
Waste Management	25.9
Lighting Equipment	10.3
Egress Accessories - Hatch	3.0
Case Assembly - Map and Manual	2.0
Structural Seats and Supports	258.0
Shelf Assy Work/Food Preparation	1.8
TOTAL CREW SYSTEMS	331.0





DETAIL WEIGHT STATEMENT

COMMAND MODULE

COMMUNICATIONS

ITEM	CURRENT WEIGHT 10-1-63
COMMUNICATIONS	
C-Band Transponder Unified S-Band S-Band Power Amplifier VHF FM Transmitter/HF Transceiver VHF AM TransRec/VHF Rec. Bea. Multiplexer Spares Signal Conditioner Recorder Audio Center Premodulation Processor Central Timing Equipment Up Data Link and Provisions VHF-HF Diplexer VHF-UHF Diplexer Remote Equipment VHF-HF Recovery Antenna & Transmission C-Band Antenna & Transmission VHF Scimitar Antenna and Transmission 2-KMC Scimitar Antenna and Transmission Electrical Provisions Electrical Provisions Electrical Wiring Data Distribution Panel	(239.1) 20.8 25.0 20.5 15.9 14.0 11.0 19.0 32.8 25.4 8.0 25.0 1.7 .8 (33.9) 9.6 9.8 6.8 4.9 2.8 (95.0) 90.0 5.0
TOTAL COMMUNICATIONS	368.0





CONFIDENCE

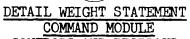
DETAIL WEIGHT STATEMENT

COMMAND MODULE

INSTRUMENTATION

ITEM	CURRENT WEIGHT 10-1-63
INSTRUMENTATION	
Lower Equipment Bay PCM Unit No. 1 PCM Unit No. 2 Nuclear Radiation Detection Equipment	(58.0) 26.2 20.8 11.0
Remote Equipment Sensors Nuclear Radiation Detection Provisions TV Camera	(46.0) 35.0 6.0 5.0
Right Hand Bay Forward Inflight Test System	(49.0)
Comparators and Power Supply Lamps Switches Meter Chassis	34.5 4.0 1.4 1.0 8.1
Electrical Provisions Inflight Test Electrical Provisions Data Distribution Panel	(40.0) 36.1 3.9
	-
TOTAL INSTRUMENTATION	193.0





COMMAND MODULE	
CONTROLS AND DISPLAYS	CURRENT
	WEIGHT
ITEM	10-1-63
MAIN DISPLAY PANEL	
Main Display Panel Control Station	(52.8)
SCS Mode Select	5.9
Delta Velocity	3.9
Flight Director Attitude Indicator	11.5
Attitude Set and Gimbal Position Display	7.6
Entry Monitoring Indicator	15.0
Launch Vehicle Emergency Detection System C-1	3.9
Master Caution and Abort Lt.	.3
IFTS Switch	.1
Barometric Indicator	1.8
Event Timer	1.5
Mounting Panels	1.3
Montettig 1 gueta	1.0
Main Display Panel Center Station	(59.8)
Audio Panel	1.7
Abort Light	.2
Reaction Control	9.5
GMT Readout	.8
ECS Gages and Controls	7.2
Crew Safety Controls	1.6
· · · · · · · · · · · · · · · · · · ·	3.0
High Gain Antenna Control	15.0
G & N Computer Keyboard	3.0
Radiation Displays	6.4
Cryogenic	6.1
Caution and Warning Display	
Mounting Panels	5.3
Main Display Panel System Management Station	(28.4)
Communications Control Panel	4.8
Master Caution Lights	.1
Power Distribution	6.7
Fuel Cells Controls	4.4
	8.1
Service Propulsion IFTS Switch	.1
— · · · · · · · · · · · · · · · · · · ·	.1
Oxygen Warning	4.1
Mounting Panels	4.1
Main Display Panel RH Console	(9.5)
Bus Switches	5.0
Audio Panel	1.7
Lighting Control	1.1
Mounting Panels	1.7
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Main Display Panel LH Console	(6.7)
Mission Sequence Controls	•9
Lighting Control	1.1
Audio Panel	1.7
SCS Power Control	1.3
Mounting Panels	1.7





DETAIL WEIGHT STATEMENT

COMMAND MODULE

CONTROLS AND DISPLAYS

ITEM	CURRENT WEIGHT 10-1-63
REMOTE EQUIPMENT	
Lower Equipment Bay Lighting Control Panel G & N Controls and Displays Map and Data Viewer Display and Control - Navigation Display and Control - Computer 15.0	(50.4) 1.2 49.2
Left Hand Forward Equipment Bay Clock Event Timer Mounting Panel	(1.8) .8 .8 .2
Crew Area Controls Manual Control - Rotation Manual Control - Translational	(24.4) 14.2 10.2
Caution and Warning Detector Spares	(16.5) 14.0 2.5
Electrical Provisions Electrical Wiring SCS/G & N Display Junction Box	(30.7) 29.0 1.7
TOTAL REMOTE EQUIPMENT	123.8
TOTAL MAIN DISPLAY PANEL (Brought forward from Page 37)	157.2
TOTAL CONTROLS AND DISPLAYS	281.0



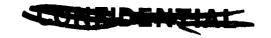


DETAIL WEIGHT STATEMENT

COMMAND MODULE

GUIDANCE & NAVIGATION

ITEM	CURRENT WEIGHT 10-1-63
GUIDANCE AND NAVIGATION	
Lower Equipment Bay Inertia Platform Sextant Telescope - Scanning Navigation Base Computer Power Servo Assy Coupling Display Unit Junction Box Cabling - MIT Cabling - NAA Spares Optical Base Eye Pieces Bellows and Adapter Loose Stored Items	59.0 12.0 9.0 27.2 74.0 54.7 16.5 12.2 35.0 16.5 62.0 21.0 3.8 12.6 9.5
TOTAL GUIDANCE AND NAVIGATION	425.0





DETAIL WEIGHT STATEMENT

COMMAND MODULE

STABILIZATION AND CONTROL

ITEM	CURRENT WEIGHT 10-1-63
STABILIZATION AND CONTROL	
Lower Equipment Bay Rate Gyro Package Body Mounted Gyro Package Electronic Control Package - Pitch Electronic Control Package - Roll Electronic Control Package - Yaw Electronic Control Package - Auxiliary Display/BMAG ECA Package Spare Gyro - BMAG (2) Spare Gyro - Rate Spare Plug-in Module	(224.5) 7.1 12.4 36.7 36.4 36.7 36.2 44.5 2.0 .5 12.0
Electrical Provisions Wiring, etc. SCS Power Junction Box	(17.5) 16.0 1.5
TOTAL STABILIZATION AND CONTROL	242.0





DETAIL WEIGHT STATEMENT

COMMAND MODULE

REACTION CONTROL SYSTEM

ITEM		CURRENT WEIGHT 10-1-63
REACTION CONTROL SYSTEM		
Propellant Systems		(74.6)
Oxidizer System Tanks & Expulsion Devices Plumbing, Fittings & Insulation Valves & Regulators Sensors	15.0 11.4 10.3 .5	37.2
Fuel System Tanks & Expulsion Devices Plumbing, Fittings & Insulation Valves & Regulators Sensors	15.2 11.4 10.3 .5	37 .4
Pressure System Tanks (4500 psi) Plumbing, Fittings & Insulation Valves & Regulators Sensors		(55.4) 9.5 4.8 38.6 2.5
Engine System Engines Nozzle Extension		(138.0) 96.0 42.0
Electrical Provisions		(23.0)
Dumping System Valves & Supports Controls & Electrical Provisions Plumbing & Fittings Miscellaneous		(32.0) 13.0 12.0 5.0 2.0
Access		(5.0)
TOTAL REACTION CONTROL SYSTEM		328.0



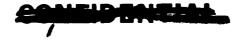
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DETAIL WEIGHT STATEMENT

COMMAND MODULE

ELECTRICAL POWER

ITEM	CURRENT WEIGHT 10-1-63
ELECTRICAL POWER	
Energy Source Battery - Re-entry (2) Battery - Post Landing (1) Battery - Pyrotechnic - Installation	(64.0) 36.0 18.0 10.0
Power Conversion Inverter (3) & Control Battery Charger & Controls PISS Battery Charging System	(117.0) 111.0 5.0 1.0
Power Distribution & Control D-C Power Panel Assy A-C Power Box Assy Battery Circuit Breaker Panel Lower Equipment Bay Panel Terminal Distribution Panel (Bus) Circuit Breaker Panel Electrical Transmission (Wiring, Connectors, Cond., Sup.) Ground Power Provisions Power Control Panel Connectors Installation Provisions	(94.8) 8.6 11.1 3.4 5.1 9.0 4.0 34.6 6.0 3.0 10.0
Electrical Common Utility Electrical Transmission (Wiring, Conn., Cond., & Sup.) Right Hand Circuit Breaker Panel Left Hand Circuit Breaker Panel Lighting Adapter Separation System LES Separation System S/M Pyrotechnic Initiation Circuit Utilization Package Sequencer Installation Provisions	(158.2) 76.7 13.0 5.4 5.0 5.0 3.5 3.0 12.8 20.0 13.8
TOTAL ELECTRICAL POWER	434.0





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DETAIL WEIGHT STATEMENT

COMMAND MODULE

ENVIRONMENTAL CONTROL SYSTEM

ITEM	CURRENT WEIGHT 10-1-63
ENVIRONMENTAL CONTROL SYSTEM	
Pressure Suit Circuit Subcontractor Compressor, Heat Exchg., Val. & Cont. Ducting, Conn., Clamps, etc. CO2 Sensor	(85.9) 71.1 12.8 2:0
Water-Glycol Circuit Subcontractor Res., Evaporator, Pump, Val. & Cont. Water-Glycol Plumbing, etc.	(59.1) 28.2 18.4 12.5
Pressure & Temp. Control Subcontractor Heat Exchg., Blower, Val. & Cont. Ducting	(18.2) 17.4 0.8
Oxygen Supply System Subcontractor Entry O ₂ Sys., Val. & Cont. Plumbing Oxygen Surge Tank	(15.1) 4.8 4.0 6.3
Water Supply System Subcontractor Potable & Waste Tanks & Freon Tank Plumbing	(38.9) 27.2 11.7
Subcontractor Common Items Brackets, Plumbing, Elect. Wiring Instrumentation	(25.8) 11.5 14.3
Supports	(12.6)
Electrical Provisions	(21.0)
Manual Controls - Push Pull	(3.6)
N ₂ Purge System	(2.8)
TOTAL ENVIRONMENTAL CONTROL SYSTEM	283.0



DETAIL WEIGHT STATEMENT

COMMAND MODULE

EARTH LANDING SYSTEM

ITEM	CURRENT WEIGHT 10-1-63
EARTH LANDING SYSTEM	
Parachute System Drogue Chute System Main Cluster Disconnect Main Cluster Pilot Chute System Sequence Control Attach Provisions	(606.3) 70.0 451.7 3.1 28.9 11.2 41.4
Location Aids	(6.3)
Forward Heat Shield Release System	(45.4)
Drogue Disconnect Installation	(9.0)
Electrical Pyrotechnic Initiation Provisions	(6.0)
TOTAL EARTH LANDING SYSTEM	673.0





DETAIL WEIGHT STATEMENT

COMMAND MODULE

USEFUL LOAD

ITEM	CURRENT WEIGHT 10-1-63
CREW SYSTEMS	
Government Furnished Equipment Pressure Garment Assembly (3) Portable Life Support System (1) Garments - Constant Wear Biomedical Instrumentation Personal Radiation Dosimeters	(158.8) 90.0 43.0 9.0 2.0 14.8
Crew (50, 70, 90 Percentile)	(528.0)
Food and Associated Equipment Food Food Containers Food Mouthpiece - Personal Water Delivery Assembly - Personal	(93.5) 75.0 15.0 2.0 1.5
Crew Accessories Lap Board Assembly Manual Set Map Set Logbook Assembly Tool Set - Inflight Maintenance	(8.0) 2.0 3.0 1.0 1.0
Crew Equipment Shoe Straps Hose Assembly - Umbilical Belt Assembly - Inflight Maintenance Hose Assembly - Recharging, Backpack Suit Electrical Umbilical and Wire	(26.2) 2.0 17.9 1.0 2.8 2.5
Waste Management	(6.8)
Medical Equipment	(15.3)
Personal Hygiene Equipment	(15.3)
Light Assembly - Portable	(3.0)
Provision Assembly - Crew Survival	(56.1)
Personal Communications	(3.0)
TOTAL CREW SYSTEM (To be brought forward)	914.0

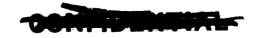


DETAIL WEIGHT STATEMENT

COMMAND MODULE

USEFUL LOAD

ITEM		CURRENT WEIGHT 10-1-63
REACTION CONTROL		(270.0)
Usable Propellant		225.0
Residual Propellant Trapped - System Mixture Ratio Expulsion Efficiency Loading Tolerance	30.8 2.7 7.8 2.7	44.0
RCS Helium		1.0
ENVIRONMENTAL CONTROL		(163.0)
Lithium Hydroxide Activated Charcoal Containers for LiOH & Charcoal Oxygen - Re-entry Freon Water-Boost Cooling Water-Emergency Re-Entry Cooling Water-PLSS Initiated Charge Water-Earth Orbit Cooling & Drinking		112.0 4.0 12.5 3.7 10.0 4.0 6.0 6.8 4.0
SCIENTIFIC EQUIPMENT		(250.0)
TOTAL THIS PAGE		683.0
TOTAL CREW SYSTEM (Brought forward from Page 45)		914.0
TOTAL USEFUL LOAD		1597.0





SOMPLE CHILDS

DETAIL WEIGHT STATEMENT

SERVICE MODULE

SUMMARY

ITEM		CURRENT WEIGHT 10-1-63
WEIGHT EMPTY		7475
Structure	2265	
Electronics	177	
Reaction Control	580	
Electrical Power	1339	
Environmental Control	92	
Propulsion	3022	
USEFUL LOAD		2230
Reaction Control	838	
Electrical Power	503	
Environmental Control	208	
Propulsion	681	
BURNOUT WEIGHT		9705
MAIN PROPELLANT		37275
GROSS WEIGHT		46980





DETAIL WEIGHT STATEMENT

SERVICE MODULE

STRUCTURE

ITEM	CURRENT WEIGHT 10-1-63
STRUCTURE	
Basic Body Structure Honeycomb Panels - Shell Radial Beams Internal Structure and Eng. Compt. Closeout Forward Bulkhead Aft Bulkhead	(1644) 762 380 43 155 304
Secondary Structure Tank Support Shelf Engine Support Antenna Support Heat Shields	(209) 33 41 30 105
Insulation	(253)
Separation Provisions and Attach	(16)
Fairing	(143)
TOTAL STRUCTURE	2265





CONTRACTOR

DETAIL WEIGHT STATEMENT

SERVICE MODULE

ELECTRONIC SUBSYSTEM

ITEM		CURRENT WEIGHT 10-1-63
ELECTRONICS SUBSYSTEM		
Communications High Gain Antenna Antenna Gimbals Earth Sensor Antenna Boom Antenna Locking Provisions Coax Coax Coax Connectors Supports Wiring	12.2 12.0 4.8	7.0 3.0 5.0 1.0 2.0
Instrumentation Sensors Electrical Provisions Supports		(129.0) 30.0 94.0 5.0
TOTAL ELECTRONICS SUBSYSTEMS		177.0





CENTER HALL

DETAIL WEIGHT STATEMENT

SERVICE MODULE

REACTION CONTROL

ITEM		CURRENT WEIGHT 10-1-63
REACTION CONTROL SYSTEM		
Propellant Systems Oxidizer System Tanks & Expulsion Devices Plumbing, Fittings & Insulation Valves & Regulators Sensors Supports Quantity Gaging	28.8 8.5 12.0 3.0 18.2 10.0	(161.4) 80.5
Fuel System Tanks & Expulsion Devices Plumbing, Fittings & Insulation Valves & Regulators Sensors Supports Quantity Gaging	29.2 8.5 12.0 3.0 18.2 10.0	80.9
Pressure System Tanks (4500 psi) Plumbing, Fittings & Insulation Valves & Regulators Sensors Supports		(128.0) 19.0 6.0 76.0 7.0 20.0
Engine System Engines Reflectors & Insulation		(150.4) 70.4 80.0
Structural Provisions		(80.0)
Electrical Provisions		(60.2)
TOTAL REACTION CONTROL SYSTEM		580.0





DETAIL WEIGHT STATEMENT

SERVICE MODULE

ELECTRICAL POWER

ITEM	CURRENT WEIGHT 10-1-63
ELECTRICAL POWER	
Fuel Cell Power System Fuel Cell Power Pack (Incl. Mount Instrumentation) Intermodular - Radiator Plumbing Fuel Cell Module Mount Attach Fuel Cell H2 System	(1172.8) 753.0 26.7 2.0
Subcontractor Components Plumbing and Valves Fuel Cell and ECS O2 System	137.8 5.5
Subcontractor Components Plumbing and Valves and Supports Water Glycol - Fuel Cell Heat Transfer System Elect. Wiring - Supercritical Gas Space Radiator (Outer Skin) Fuel Cell Module Stabilization Webs Fuel Cell Plumbing Supports	168.2 26.1 7.0 10.0 24.7 3.8 8.0
Power Distribution Electrical Transmission Power Distribution Box	(71.2) 40.0 31.2
Electrical Common Utility Electrical Transmission Sequencer Adapter Separation System C/M to S/M Separation System Pyrotechnic Initiation Provisions	(95.0) 41.0 8.0 7.0 14.8 12.0 12.2
TOTAL ELECTRICAL POWER	1339.0





DETAIL WEIGHT STATEMENT

SERVICE MODULE

MAIN PROPULSION

ITEM MAIN PROPULSION		CURRENT WEIGHT 10-1-63
Propellant Systems Oxidizer System Tanks & Doors	551.0	(1350.0) 753.3
Skirts Plumbing, Fittings & Insulation Valves Quantity Indication Mixture Ratio Control	59.8 53.0 4.5 25.5 14.0	
Supports - Plumbing & Equipment Fuel System	45.5	596. 7
Tanks & Doors Skirts Plumbing, Fittings & Insulation Valves Quantity Indication Supports - Plumbing & Equipment	458.0 33.2 42.0 4.5 25.5 33.5	
Pressure System Tanks (4400 psi) Tank Supports Plumbing, Fittings & Insulation Valves, Regulators & Heat Exchanger Supports - Plumbing & Equipment		(915.0) 774.0 30.0 24.0 49.0 38.0
Engine System Engine Closeouts - Throat to S/M		(715.0) 6 90.0 25.0
Electrical Provisions		(42.0)
TOTAL MAIN PROPULSION SYSTEM		3022.0





COMPRESENTIAL

DETAIL WEIGHT STATEMENT

SERVICE MODULE

ENVIRONMENTAL CONTROL SYSTEM

ITEM	CURRENT WEIGHT 10-1-63
ENVIRONMENTAL CONTROL SYSTEM	
Water-Glycol Circuit Subcontractor Valves & Controls Plumbing and Hardware Water - Glycol Space Radiator (Outer Skin)	(75.0) 5.6 22.1 10.0 37.3
Water Supply System Subcontractor Valves & Controls Plumbing and Hardware Miscellaneous Brackets & Supports	(7.2) .1 7.0 .1
Oxygen Supply System Plumbing and Supports	(3.0) 3.0
Common Items Supports	(6.8) 6.8
TOTAL ENVIRONMENTAL CONTROL SYSTEM	92.0





CONTIDUCTAL

DETAIL WEIGHT STATEMENT

SERVICE MODULE

USEFUL LOAD

ITEM		CURRENT WEIGHT 10-1-63
REACTION CONTROL		(838.0)
RCS Propellant Usable Residual Trapped System Mixture Ratio Expulsion Efficiency Loading Tolerance RCS Helium	790.0 45.0 4.0 9.0 24.0 8.0	835.0
ELECTRICAL POWER (Normal Mission)		(503.0)
Hydrogen - Supercritical Gas Usable (Electrochemical Incl. Tolerance) Unusable (Residual & Instrument Error) Emergency Provisions Expended (Leakage & Purge) Oxygen - Supercritical Gas Usable (Electrochemical Incl. Tolerance) Unusable (Residual & Instrument Error) Emergency Provisions Expended (Leakage & Purge)	46.0 3.2 4.7 4.6 377.0 17.5 44.0 6.0	58.5 444.5
ENVIRONMENTAL CONTROL (Normal Mission) Oxygen - Supercritical Gas Usable (Metabolic) Unusable (Residual & Instrument Error) Emergency Provisions Expended (Leakage, LEM, PLSS, Repress.)	76.5 9.1 25.3 97.1	(208.0) 208.0
PROPULSION Main Propulsion Helium Main Propellant Residuals		(681.0) 99.0 582.0
Trapped - System Trapped - Engine Mixture Ratio Tolerance Loading Tolerance	225.0 67.0 100.0 190.0	
TOTAL USEFUL LOAD (Less Main Propellant)		2230.0
E I	GTD 60 00-20	



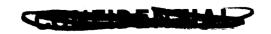


DETAIL WEIGHT STATEMENT

LAUNCH ESCAPE SYSTEM

SUMMARY

ITEM	CURRENT WEIGHT 10-1- 63
LAUNCH ESCAPE SYSTEM	
Structure	(1062)
Tower Assy Escape Motor Skirt Pitch Motor Structure Nose Cone and Ballast Support Attaching Parts Tower Insulation Skirt Insulation	348 209 155 114 10 216 10
Separation Provision	(67)
Ballast	(508)
Propulsion	(5345)
Escape Motor Jettison Motor Jettison Motor Skirt Pitch Control Motor	4764 434 92 55
Electrical Power	(58)
TOTAL LAUNCH ESCAPE SYSTEM	7040





CONTINUE

DETAIL WEIGHT STATEMENT

ADAPTER

SUMMARY

ITEM	CURRENT WEIGHT 10-1-63
ADAPTER Structure	(3070)
Panels	2470
Frames	200
Thermal Insulation	400
Electrical Power	(80)
Separation System	(250)
TOTAL ADAPTER	3400